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Final Manual

Prepared for

Naval Civil Engineering Laboratory
Port Hueneme, California 93043

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**DIVER LIFT SYSTEM
OPERATION AND MAINTENANCE
MANUAL**

Contract N00123-84-D-0130

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Prepared by

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SAFETY SUMMARY

The diver lift system does not present a safety problem if operated according to proper procedure as stated in this document. Due to the heavy weights involved, changing weather conditions, and uncertain water currents, several precautions that should always be used are taken from the text and restated here.

1. AIR BUBBLE CONTRACTION / EXPANSION IN THE LIFT BAG COULD CAUSE AN UNCONTROLLED DESCENT / ASCENT OF THE LOAD, RESULTING IN POSSIBLE DAMAGE TO EQUIPMENT AND INJURY TO DIVING PERSONNEL. DIVERS SHOULD TAKE SPECIAL PRECAUTION IN CONTROLLING THE LIFT BAG AND IN STAYING OUT FROM UNDERNEATH THE LOAD.

2. SWINGING OF LOADS COULD RESULT IN DAMAGE TO EQUIPMENT AND INJURY TO PERSONNEL. ALL PERSONNEL NEAR THE VICINITY OF THE CRANE ARE REQUIRED TO USE HARD HATS. SPECIAL ATTENTION IS REQUIRED OF PERSONNEL TENDING THE TETHERING LINES ATTACHED TO THE LIFT BAG/LOAD TO MINIMIZE THE PENDULUM EFFECT.

3. AIR BUBBLE EXPANSION IN THE LIFT BAG COULD CAUSE AN UNCONTROLLED ASCENT. RAPID SURFACING OF THE LIFT BAG COULD EXPEL AIR, CAUSING THE LIFT BAG AND LOAD TO DESCEND UNCONTROLLED.

4. OPERATION OF LIFT BAGS IN CONDITIONS OF EXCESSIVE CURRENT OR SURGE IS HAZARDOUS AND CAN RESULT IN DIVER FATIGUE. COMMENCEMENT OF THE LIFT OPERATION IS DEPENDENT ON SAFE ENVIRONMENTAL CONDITIONS (TO BE DETERMINED BY THE DIVING SUPERVISOR).

5. FORCE REQUIRED TO RAISE AN OBJECT MAY BE SUBSTANTIALLY MORE THAN THE UNDERWATER WEIGHT OF THE OBJECT. THE FORCE, RESULTING FROM SUCTION CREATED BY THE OBJECT IMBEDDED INTO THE SEAFLOOR, WILL CAUSE A RAPID AND POTENTIALLY DANGEROUS ASCENT CONDITION UNLESS IMMEDIATELY CONTROLLED BY THE IRIS DIAPHRAGM DUMP VALVE/ZIPPER COMBINATION.

6. USE OF A FRAYED OR WORN CRANE HOIST LINE CAN RESULT IN PERSONNEL INJURY, DAMAGE TO THE DIVER LIFT SYSTEM, AND SUBSEQUENT UNCONTROLLED DESCENT.

1.0 GENERAL INFORMATION

1.1 Introduction

This manual contains information regarding the safe operation and proper maintenance of the Diver Lift System. The diver lift system has been developed by the Naval Civil Engineering Laboratory (NCEL) to permit the safe and effective lifting of objects when working underwater.

1.2 Content

The manual is divided into five parts: General Information (Section 1), Functional Description (Section 2), Operation (Section 3), Maintenance (Section 4), and Parts List (Section 5).

1.3 Theory

The lift bags operate according to Archimede's principle which states that a body wholly or partly immersed in a fluid is buoyed up with a force equal to the weight of the fluid displaced by the body. Therefore the lifting force required is attained by using air to displace a volume of water that weighs more than the weight of the submerged object. The volume of air needed is obtained from SCUBA tanks or a surface compressor and is contained by the structure of the lift bag(s).

1.4 System Description

The Diver Lift System is composed of 3 sizes of open bottom lift bags. The largest bag is capable of lifting a range of objects weighing from 1000 to 3000 pounds. The medium bag is capable of lifting a range of objects weighing from 500 to 1250 pounds. The small

bag is capable of lifting a range of objects weighing from 220 to 550 pounds.

Each lift bag has features permitting general buoyancy adjustment and fine trimming capability for maneuvering various loads. The maximum weight to be lifted is adjusted by setting a leakproof zipper that has been integrated into the side of the bag. The zipper is positioned relative to weight designations that have been printed on the bag. The ascent/descent rate and hovering capability of the bag is controlled by the diver. The large bag uses a 6 inch iris diaphragm dump valve. The medium and small bags each use a 4 inch iris diaphragm valve. When the bag is ascending or descending too quickly the diver may use the iris diaphragm dump valve or fill valve to control the system buoyancy.

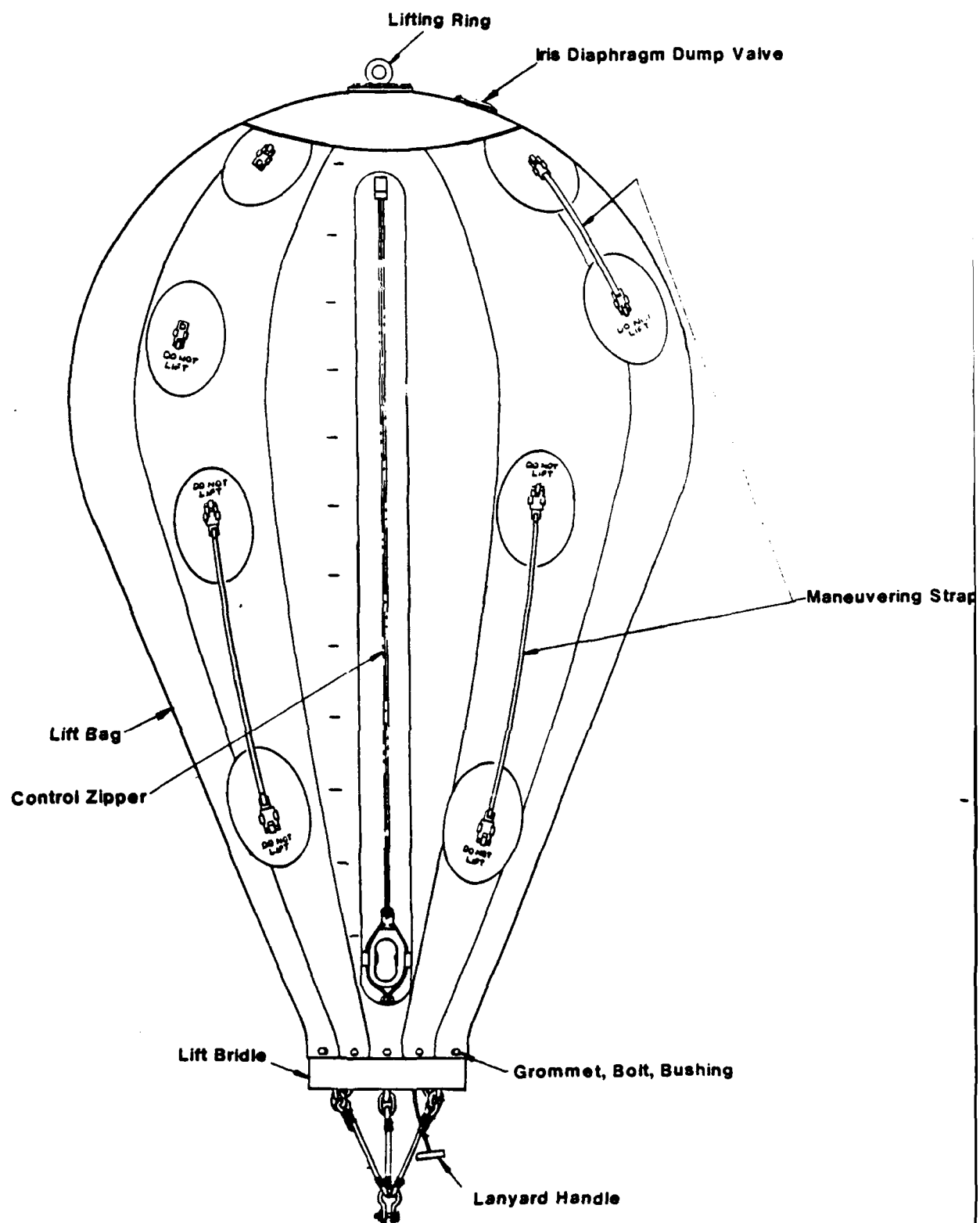
2.0 FUNCTIONAL DESCRIPTION

2.1 Introduction

This section describes the functions of the lift system and the theory of operation.

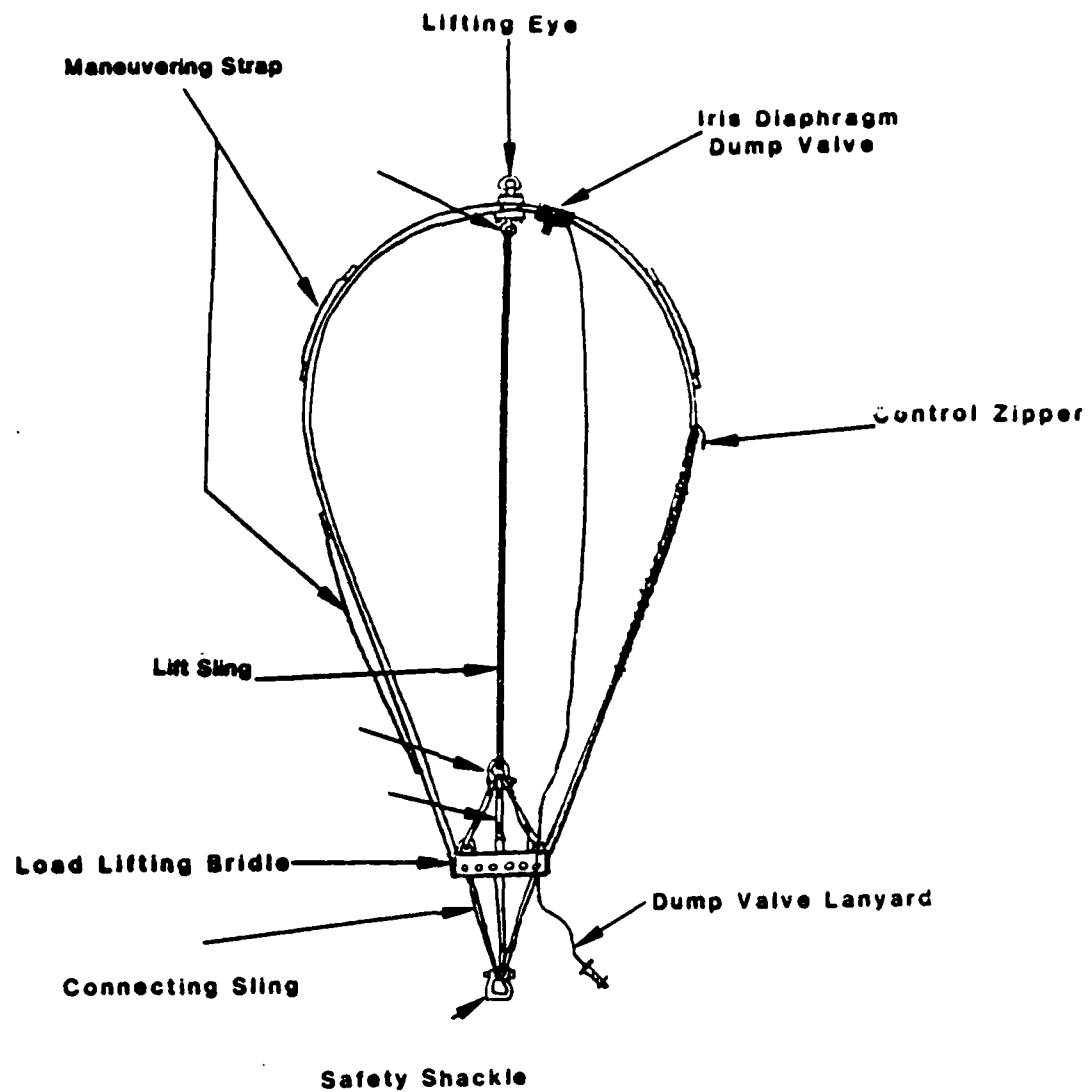
2.2 System Function

The function of the diver lift system is to use air as a means of lifting and moving heavy objects underwater. The diver lift system uses three sizes of bags, to accomplish this.



Lift Bag Assembly

EXHIBIT 2-1



Lift Bag Assembly (Cutaway)

EXHIBIT 2-2

2.3 Component Function

2.3.1 Lift Bag W/Zipper

The lift bag with zipper comprises the main body of the diver lift system. The lift bag, fabricated from Neoprene coated Nylon, is used to contain the air that is required for lifting. The zipper controls the volume of air that is used to displace water. By controlling the volume of air, the zipper is capable of regulating the maximum weight lifted by the bag (See Exhibit 2-1).

2.3.2 Iris Diaphragm Dump Valve Assembly

The iris diaphragm dump valve is used to control the ascent and descent of the lift bag by permitting the regulated release of air through an opening and closing rubber diaphragm (See Exhibit 2-2 and 2-3). The valve is opened by pulling on the dump valve lanyard, and is automatically spring closed upon release.

2.3.3 Fill Valve Assembly

The fill valve assembly is used to supply air to the bag from a compressor located on the surface. The fill valve assembly is comprised of two valves, a trigger actuated spindle valve and a plug valve (See Exhibit 2-4).

2.3.4 Lift Bridle Assembly

The lift bridle assembly consists of the lift bridle, shackles, and kevlar slings. The lift bridle assembly is used to transfer the lifted load to the bag while underwater. When the load is lifted out of the water the bridle assembly

transfers the load through the center lift line to the crane, bypassing the lift bag material (See Exhibit 2-2).

2.3.5 Maneuvering Straps

The maneuvering straps are located on the upper and lower portions of the lift bag and are used by the divers to position the bag during ascent and descent (See Exhibit 2-1).

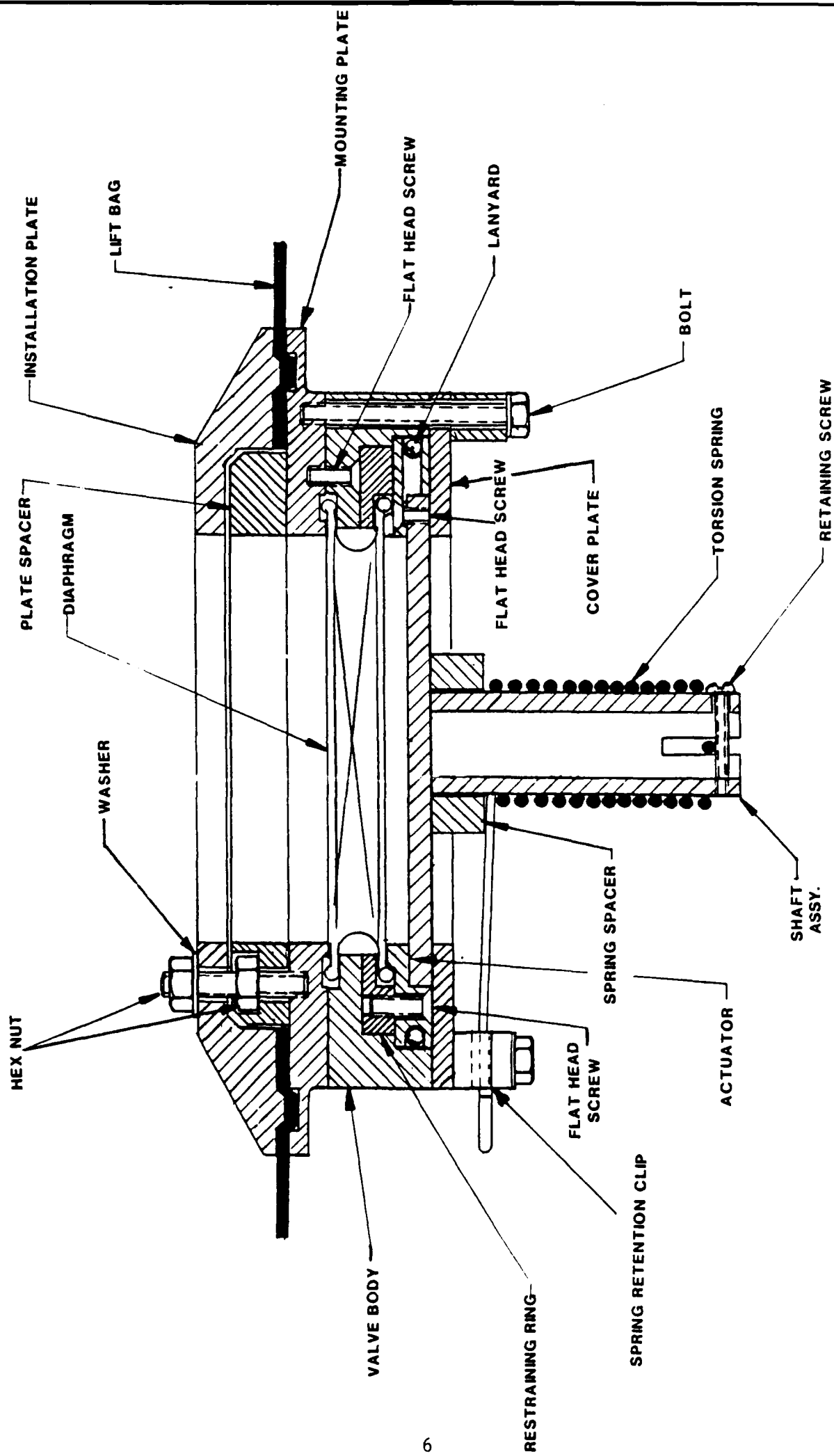
2.3.6 Lifting Ring

The lifting ring is located at the very top of the bag and is used as the crane attachment point for lifting the recovered load from the water (See Exhibit 2-5).

3.0 OPERATIONS

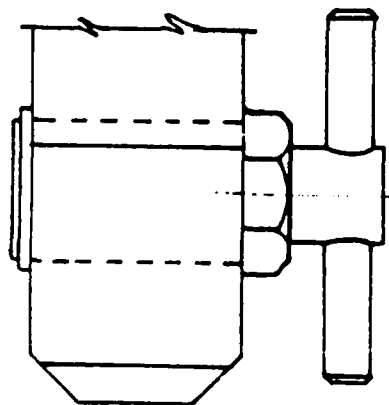
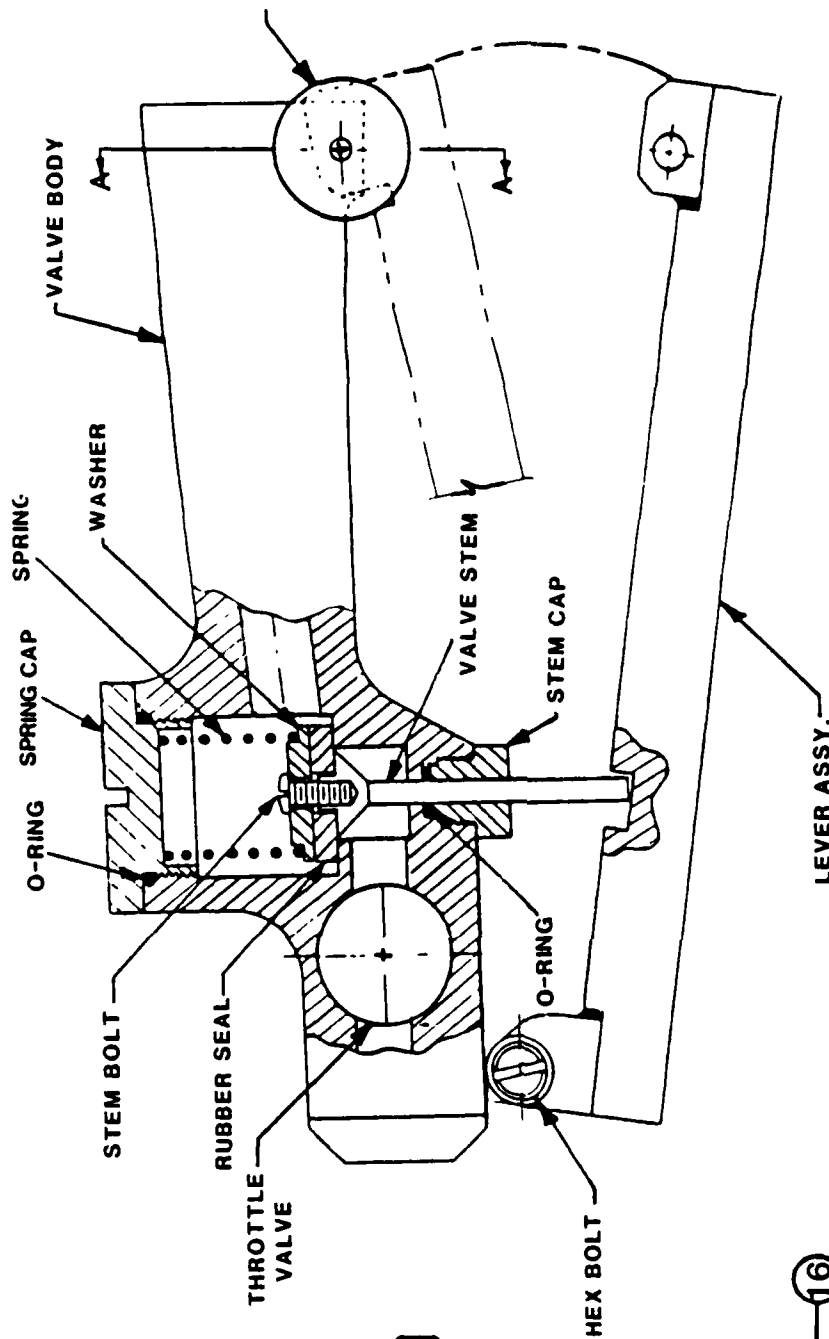
3.1 INTRODUCTION

Procedures for operating the diver lift system are presented in this section in the general order in which operations are carried out. Notes and cautions are inserted at appropriate places in the text in this and the next section. A note will emphasize a particular element of the text considered essential to an operating or maintenance procedure or condition but not critical to the safety of equipment or personnel. A caution statement will emphasize an operation or maintenance procedure that if not strictly observed, could result in damage to, or destruction of, equipment. See Safety Summary on page 1.

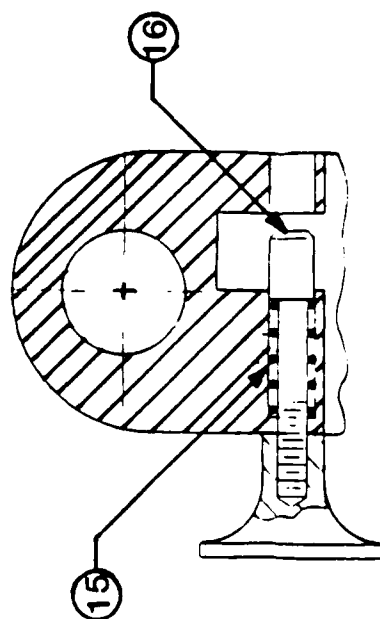


DIAPHRAGM DUMP VALVE (CUTAWAY)

EXHIBIT 2-3

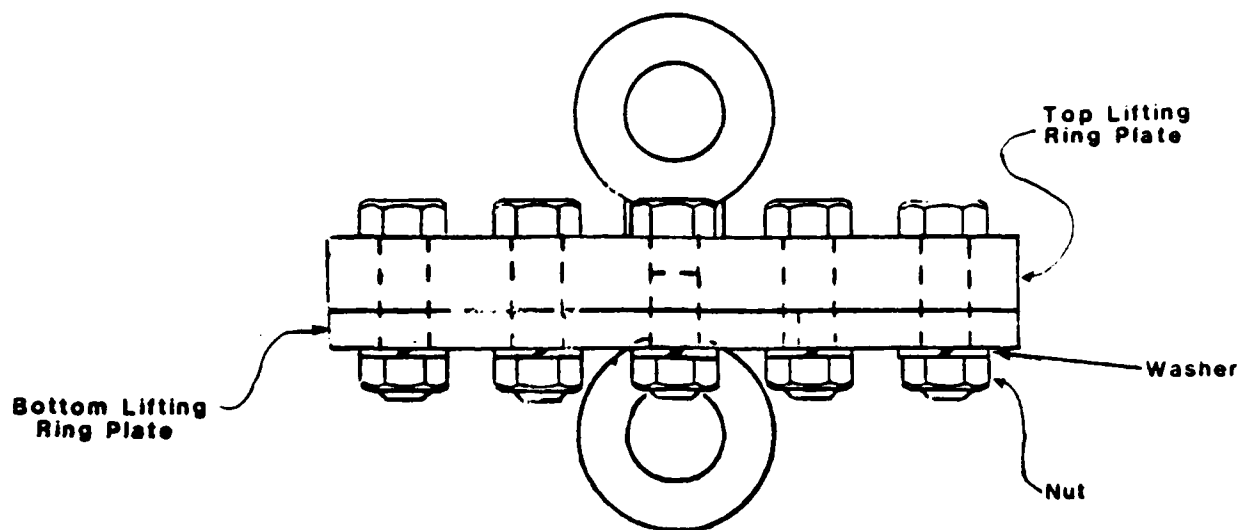


DETAIL-14
THROTTLE-VALVE



SECTION A-A

AIR FILL VALVE (CUTAWAY)
EXHIBIT 2-4



Lifting Ring

EXHIBIT 2-5

3.2 PRE-OPERATIONAL CHECKOUT

The following steps should be taken before putting the diver lift system in its operational (underwater) environment. Exhibit 2-1 shows the location of all system components.

1. Assess the object to be lifted and estimate the weight.
2. Select the range of bag that most closely approximates the weight of the object to be lifted.
3. Examine the system for any wear or rips in the bag.
4. Check each lift bridle sling for frays or cuts and replace if necessary.
5. Actuate the iris diaphragm dump valve and the fill valve to assure that they are in proper working order and lubricate if necessary.
6. Assure that all fittings, shackles, and bolts are properly tightened and in their correct positions.
7. Examine all metal parts for corrosion and replace as necessary.
8. If the fill valve is being used, assure that the compressor supplying air is in good working condition and that the hose used with the fill valve is of adequate length and in good repair.
9. Determine the **Maximum Lift Clearance (MLC)** by measuring the vertical distance of the fully raised crane hook above the top of the ship rail.
10. Determine the **Load Lift Height (LLH)**.

**LLH = LIFT BAG HEIGHT +
ATTACHED OBJECT HEIGHT**

NOTE: If LLH is less than MLC, the load may be lifted by attaching the crane hook to the lifting ring at the top of the lift bag.

If LLH is greater than MLC, the load must be lifted by attaching the crane hook to the shackle of the connection slings, or directly to the object.

11. Check the current velocity in the area of operations. If the current will hinder positioning during ascent and descent, attach a tag line to the lifting eye for assistance.

3.3 OPERATION

The diver lift system is mostly used for two types of operations. The first is to raise an object from the seafloor to the deck of a ship. The second is to lower an object from the deck of a ship to the seafloor. The following procedures will cover the safe and effective use of the system for each of the operations.

3.3.1 RAISING AN OBJECT

1. After following the pre-operational checkout, place the lift bag in the water with a tag line if necessary. Raise the zipper to the top of the bag.
2. Invert the lift bag in the water to permit any trapped air inside to escape permitting easier transportation to the object of interest.

3. Transport the lift system down to the object to be lifted.

4. Assess the object for lifting and attachment points that will provide the most stable attitude for the object when it is lifted.

5. Put the attachment lines on the object. Then secure the lines to the shackle of the connection slings on the lift bridle assembly.

6. Fill the lift bag with enough air, using the fill valve or SCUBA tanks, to float it above the object to be lifted.

7. While the bag is floating above the object, position the zipper to the approximate weight, as printed on the side of the bag, for the object.

8. Make a final examination of the bag and location of the attachment lines. Assure that they are properly situated and that all divers are clear of the lift path and prepared to assist in maintaining the bag position.

9. Fill the bag with air until it just starts to leave the seafloor.

10. As soon as the object starts to leave the seafloor, stop filling the bag with air.

CAUTION: THE INITIAL LIFTING FORCE TO RAISE THE OBJECT MAY BE SUBSTANTIALLY MORE THAN THE UNDERWATER WEIGHT OF THE OBJECT. THIS FORCE, RESULTING FROM SUCTION CREATED BY THE OBJECT IMBEDDED INTO THE SEA-FLOOR, WILL CAUSE A RAPID AND POTENTIALLY DANGEROUS ASCENT CONDITION UNLESS IMMEDIATELY CONTROLLED BY THE IRIS DIAPHRAGM DUMP VALVE/ZIPPER COMBINATION.

NOTE: The object will now start to rise toward the surface. As the water depth decreases the volume of air within the bag will start to expand. If the zipper has been properly positioned the increased volume of air will start to spill out. If the zipper is down too low, the volume of air contained will allow the bag to rise too quickly. This situation can be immediately alleviated by using the dump valve to exhaust some air to reduce or stop the ascent. However, proper setting of the zipper to achieve neutral buoyancy of the lift bag and object provides the most control and is, therefore, the safest means of handling the load.

11. Use the iris diaphragm dump valve and the fill valve to control the ascent and hovering capability of the system.

CAUTION: THE ZIPPER POSITION MAY BE SLOWLY REPOSITIONED TO COMPENSATE FOR THE ACTUAL WEIGHT OF THE OBJECT. EXTREME CARE MUST BE TAKEN WHEN DOING THIS BECAUSE A CATASTROPHIC LOSS OF BUOYANCY COULD OCCUR, RESULTING IN UNCONTROLLED DESCENT AND POSSIBLE INJURY.

12. Upon reaching the surface, fully close the zipper and add air from the fill valve.

13. Allow the fill valve to throttle some air into the bag as a safety precaution in case of lost buoyancy.

14. Attach the lifting line from the ship onto the lifting ring on the lift bag, or onto the shackle of the connection slings, as determined during step 10 of the pre-operational checkout.

NOTE: The object may be towed instead of lifted. If the towing line is secured to the object instead of the lift bag, assure that the bag is taken aboard or secured to prevent it from acting as a sea anchor.

15. Attach tag lines to control the motion of the object as it is being lifted.

16. Lift the object onto the vessel.

CAUTION: SWINGING OF LOADS COULD RESULT IN DAMAGE TO EQUIPMENT AND INJURY TO PERSONNEL. ALL PERSONNEL NEAR THE VICINITY OF THE CRANE ARE REQUIRED TO USE HARD HATS. SPECIAL ATTENTION IS REQUIRED OF PERSONNEL TENDING THE TAG LINES ATTACHED TO THE LIFT BAG/LOAD TO MINIMIZE THE PENDULUM EFFECT.

3.3.2 LOWERING AN OBJECT

1. After following the pre-operational checkout, securely fasten attachment lines to the object.

2. Secure the attachment lines to the shackle of the connection slings on the lift bridle assembly.

3. Attach the crane hook to the lifting eye of the lift bag or to the shackle of the connection slings (see step 10 of the pre-operational checkout).

4. Lift the object and lift bag from the ship deck and lower them approximately 15 feet below the water surface.

CAUTION: SWINGING OF LOADS COULD RESULT IN DAMAGE TO EQUIPMENT AND INJURY TO PERSONNEL. ALL PERSONNEL NEAR THE VICINITY OF THE CRANE ARE REQUIRED TO USE HARD HATS.

SPECIAL ATTENTION IS REQUIRED OF PERSONNEL TENDING THE TAG LINES ATTACHED TO THE LIFT BAG/LOAD TO MINIMIZE THE PENDULUM EFFECT.

CAUTION: OPERATION OF LIFT BAGS IN CONDITIONS OF EXCESSIVE CURRENT OR SURGE IS HAZARDOUS AND CAN RESULT IN DIVER FATIGUE. COMMENCEMENT OF THE TEST OPERATION IS DEPENDENT ON SAFE ENVIRONMENTAL CONDITIONS (TO BE DETERMINED BY THE DIVING SUPERVISOR).

5. Fill the lift bag with air until slack is seen on the crane hoist line.

Note: When the lift bag is filled with air it will press tightly against the crane hoist line. Assure that the hoist line has no protrusions that could damage the lift bag.

CAUTION: USE OF A FRAYED OR WORN CRANE HOIST LINE CAN RESULT IN PERSONNEL INJURY, DAMAGE TO THE DIVER LIFT SYSTEM, AND SUBSEQUENT UNCONTROLLED DESCENT.

6. Release the crane hoist line from the lift bag/load and raise it out of the water.

7. Remove all tag lines.

8. Slowly vent air with the iris diaphragm dump valve until the bag/load starts to descend.

9. As the bag descends use the air fill valve and dump valve to control the descent.

CAUTION: AIR BUBBLE CONTRACTION / EXPANSION IN THE LIFT BAG COULD CAUSE AN UNCONTROLLED DESCENT/ASCENT OF THE LOAD, RESULTING IN POSSIBLE DAMAGE TO EQUIPMENT AND INJURY TO DIVING PERSONNEL. DIVERS SHOULD TAKE SPECIAL PRECAUTION IN CONTROLLING THE LIFT BAG AND STAYING OUT FROM UNDERNEATH THE LOAD.

10. As the load approaches the seafloor, slow the descent and hover with the load.

11. Move the load to the desired location.

12. Position the load as required and slowly vent air with the dump valve until the load is resting on the seafloor.

13. Vent air with the dump valve until slack occurs in the connection slings.

14. Remove all fasteners securing the load to the lift system.

Note: Assure that the lift bag can be kept under control when releasing the load.

15. Slowly swim the lift bag to the surface.

3.4 DAILY MAINTENANCE

The diver lift system must be cleaned at the end of each days use. All components should be flushed with fresh water to remove all residual salt, silt, mud, and seawater. Lift bags should be inspected for holes, cuts, or severe abrasion and required repairs made. Valves should be checked for actuation. The stem of the fill valve should be sprayed with a non-toxic silicone lubricant and the rubber diaphragm of the dump valve should be coated with a

silicone compound such as Dow 7 Compound. The zipper should be coated with bee wax or a non-toxic silicone lubricant.

4.0 MAINTENANCE

4.1 INTRODUCTION

This section provides recommended procedures for the disassembly / reassembly, cleaning, and troubleshooting for the diver lift system.

4.2 GENERAL CLEANING

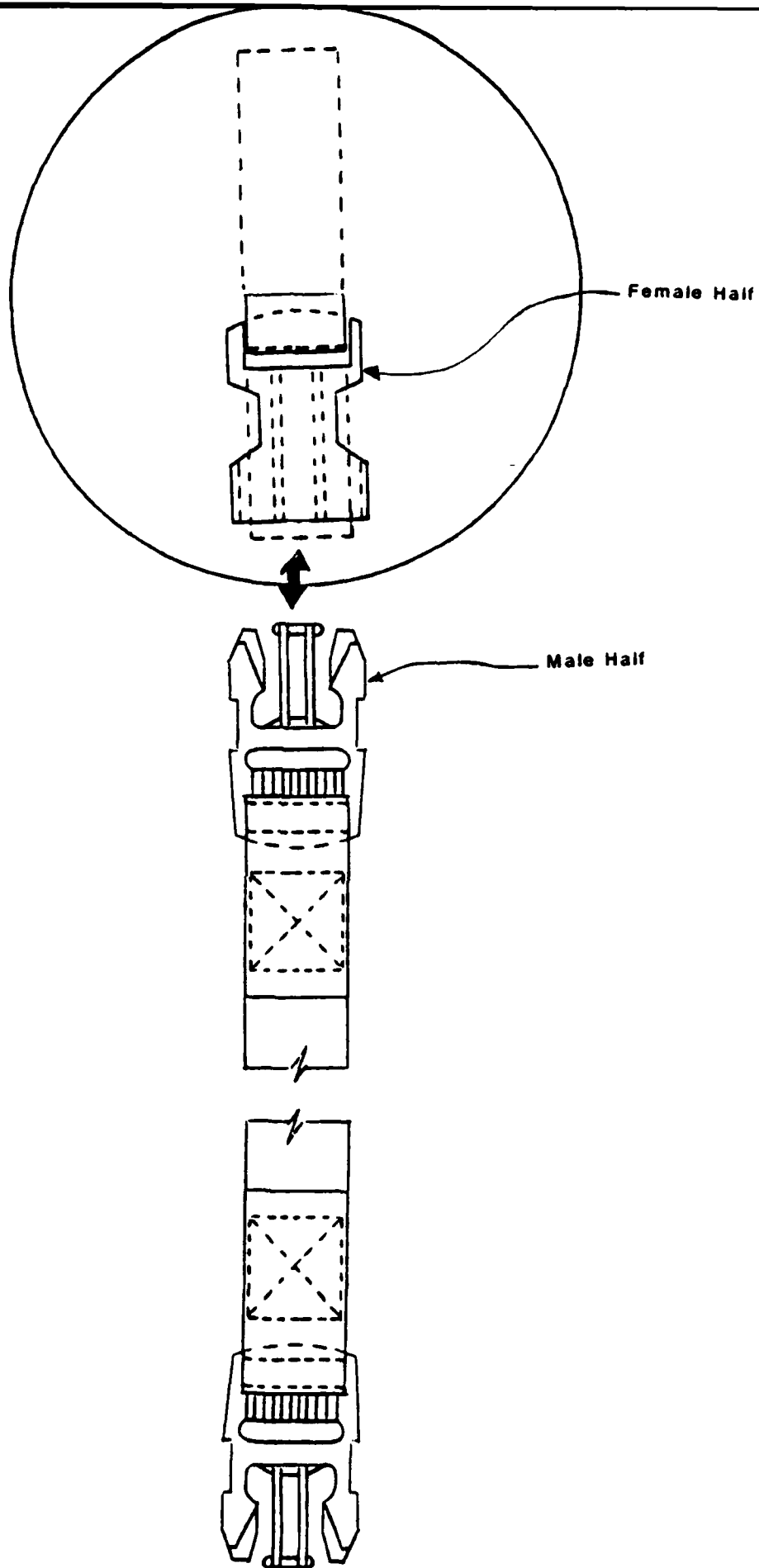
The following procedures should be followed for general cleaning of the diver lift system.

1. After use of the system in seawater, ensure that all components are thoroughly cleaned with fresh water.

2. Coat the exterior of the rubber diaphragm in the dump valve with a light coating of silicone lubricant (such as Dow 7 Compound).

3. Coat the stem of the fill valve very lightly with silicone lubricant spray.

4. Apply a light coat of bees wax or silicone lubricant (such as Dow 7 Compound) to the lift bag zipper and open and close several times for even and complete distribution.



Maneuvering Strap
EXHIBIT 4-1

4.3 DISASSEMBLY / REASSEMBLY

The major disassembly of the diver lift system should be unnecessary except in circumstances such as the severe impairment of the total system due to damage, severe soiling (such as oil), or the replacement of numerous components. Normal hand tools such as pliers, wrenches, socket set, and screwdrivers are required for disassembly / reassembly.

4.3.1 LIFT BRIDLE ASSEMBLY

To disassemble the lift bridle assembly the following steps are performed.

1. Remove the ten 3/8 inch hex head bolts and flanged delrin bushings from the perimeter of the lift bridle.

2. Remove the 6 shackles attached to the eyes on the lift bridle by first removing the cotter pins and then pulling the pin fastener.

3. The short and long connecting slings are disassembled from the safety anchor shackles by first removing the cotter pin, then unthreading the nut from the pin fastener, and pulling the pin from the shackle.

4. The lift bridle assembly is reassembled by reversing the preceding steps.

4.3.2 MANEUVERING STRAPS

To disassemble the maneuvering straps the following steps are performed (See Exhibit 4-1).

1. Compress the two tongs on the side of the male half of the buckle while pulling on the strap.

2. To reassemble the handle push the two tongs of the male half of the handle into the female half until they click into place.

4.3.3 IRIS DIAPHRAGM DUMP VALVE ASSEMBLY

To disassemble the iris diaphragm dump valve the following steps are performed (See Exhibit 2-3).

1. Lay the valve and bag on some surface such as a deck or table top with the valve on top.

2. Unthread the nuts from the eight 1/4-20 threaded studs that are on the exterior of the dump valve installation plate.

3. Pull the PVC installation plate from the threaded studs.

4. Pull the remaining portion of the valve out of the bag for further disassembly.

5. Using a socket, remove the eight 1/4-20 nuts from the threaded studs that are attaching the plate spacer.

6. Remove the PVC plate spacer.

7. While firmly grasping the end of the pre-loaded spring arm, move the spring arm clear of the retention clip and slowly release the pre-load on the torsion spring by letting it unwind until it stops.

8. Pull the torsion spring from the shaft.

9. Pull the Delrin spring spacer from the shaft.

10. Unscrew the four 1/4-20 bolts holding the cover plate, spring retention clips, valve body, and mounting plate.

11. Pull the cover plate, spring retention clips, and mounting plate.

12. Unthread the six 10-32 flat head screws holding the Delrin actuator onto the stainless steel restraining ring.

13. Remove the actuator with the strut / shaft still attached by tilting up the edge of the actuator that is opposite the lanyard hole in the valve body.

14. Compress the wire in the rubber diaphragm enough to remove the stainless steel restraining ring.

15. Remove the restraining ring.

16. Unthread the two 8-32 flat head screws holding the stainless steel strut/shaft onto the Delrin actuator.

17. Remove the strut/shaft.

18. Unthread the six 10-32 flat head screws holding the Delrin valve body onto the stainless steel mounting plate.

19. Separate the valve body from the mounting plate.

20. Compress the wire in the rubber diaphragm and remove the diaphragm from the valve body.

21. Reassemble the iris diaphragm dump valve by reversing the preceding sequence.

4.3.4 LIFTING RING

To disassemble the lifting ring the following steps are performed.

1. Remove the iris diaphragm valve by following steps 1 through 4 found in Section 4.2.3.

2. Using the hole resulting from the dump valve removal, unthread the eight nuts on the underside of the lift ring.

3. Remove the nuts and the bottom lift ring plate from the inside of the bag.

4. Remove the top lift ring plate.

5. Reassemble the lift ring by reversing the preceding steps.

4.3.5 FILL VALVE ASSEMBLY

To disassemble the fill valve assembly the following steps are performed.

1. Unscrew the 10-32 x 1" lever retaining screw.

2. Remove the lever from the hinge post.

3. Unscrew the stem cap.

4. Unscrew the spring cap from the valve body.

5. Pull out the valve spring.

6. Pull out the valve stem.

7. Unscrew the 6-32 x 7/16" stem screw from the valve stem.

8. Remove the washer and rubber seal from the valve stem.

9. Remove the retaining ring from the plug valve stem (flow control valve).

10. Pull the plug valve stem out of the valve body.

11. For reassembly reverse the preceding sequence, lubricating each O-ring seal with silicone grease.

4.4 TROUBLESHOOTING

<u>Trouble</u>	<u>Cause</u>	<u>Correction</u>
Dump valve will not open	Broken lanyard	Replace lanyard
	Debris obstructing actuator	Disassemble valve and clean
Dump valve will not close	Broken torsion spring	Replace spring
	Lanyard stuck	Examine the lanyard for knots or twists
	Torn diaphragm	Replace diaphragm
Bag will not lift object	Zipper set too high	Pull zipper down to greater lifting force
	Dump valve open	Examine valve for damage
	Lift bag too small	Use larger size bag or multiple bags
Slow/No air flow out of fill valve	Low pressure	Check compressor or SCUBA tank pressure
	Stuck fill valve	Disassemble and clean valve

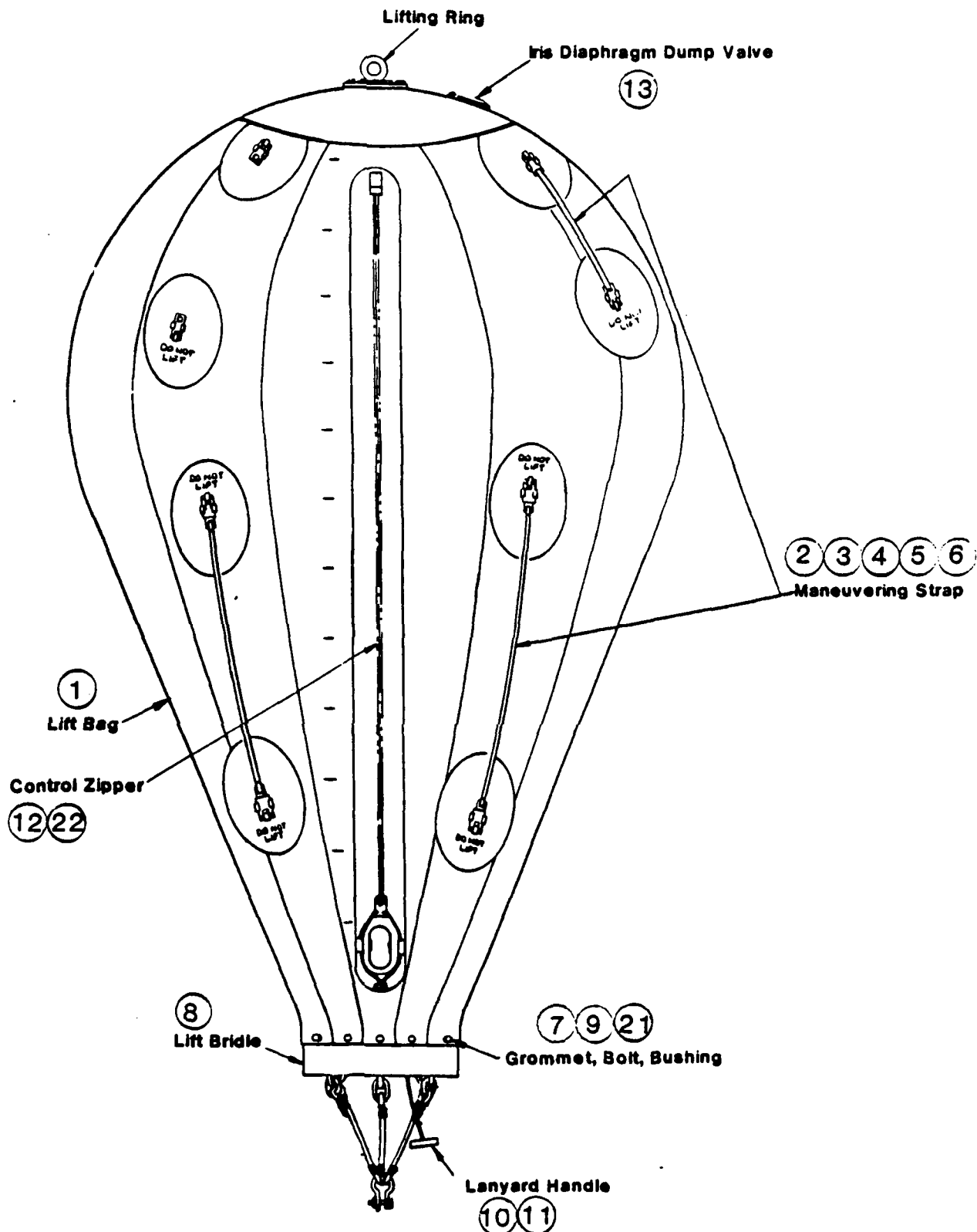
5.0 PARTS LIST

5.1 INTRODUCTION

The parts list includes all parts for the diver lift system. Exhibits 5-1 through 5-5 provide all components for the small, medium, and large lift systems. Exhibits 5-2 and 5-3 list components of valve sub-assemblies. The sub-assemblies are included as single items in Exhibit 5-1 through 5-5.

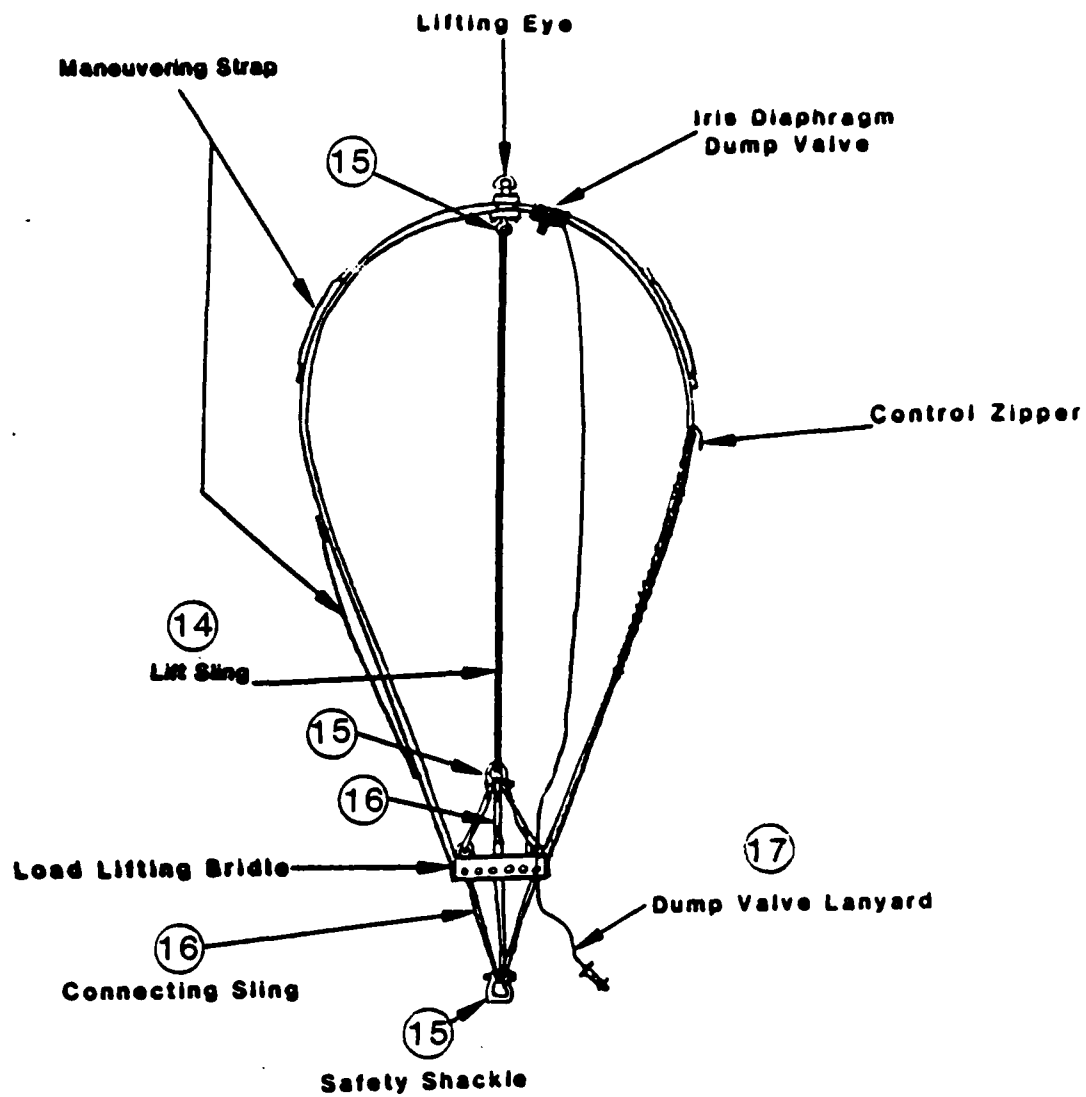
- 5.2 DIVER LIFT SYSTEM
 - 5.2.1 550 LB LIFT BAG ASSEMBLY
 - 5.2.2 1250 LB LIFT BAG ASSEMBLY
 - 5.2.3 3000 LB LIFT BAG ASSEMBLY
- 5.3 IRIS DIAPHRAGM DUMP VALVE ASSEMBLY
 - 5.3.1 4" IRIS DUMP VALVE ASSEMBLY
 - 5.3.2 6" IRIS DUMP VALVE ASSEMBLY
- 5.4 FILL VALVE ASSEMBLY
- 5.5 AIR HOSE ASSEMBLY

5.2 DIVER LIFT SYSTEM



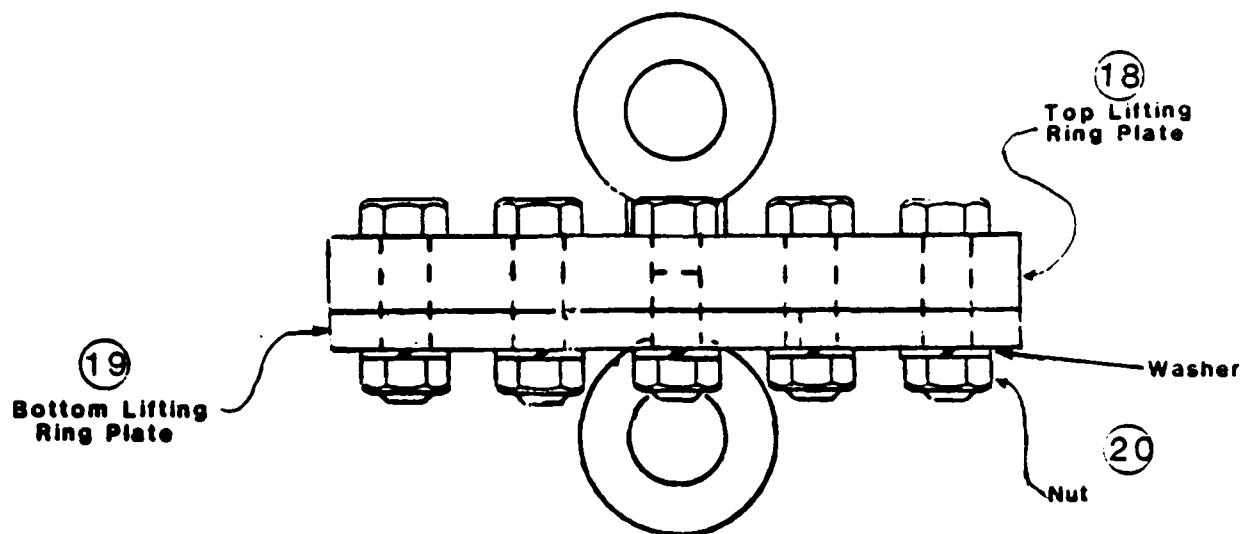
Lift Bag Assembly

EXHIBIT 5-1



Lift Bag Assembly (Cutaway)

EXHIBIT 5-2



Lifting Ring

EXHIBIT 5-3

550 LB LIFT BAG ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
1	1	Lift Bag, Neoprene Coated Nylon 220 / 550 LB Range	NCEL	EI-5101-0201
2	20	Handle Cover Patch, Neoprene Coated Nylon	NCEL	EI-5101-0301
3	2	Top Handle, 12 inch Nylon	NCEL	EI-5101-0302
4	3	Bottom Handle, 24 inch Nylon	NCEL	EI-5101-0303
5	10	Buckle, PVC Male	Fast-Tex	BSR-2M
6	20	Buckle, PVC Female	Fast-Tex	BSR-2F
7	10	Bolt, Hex HD 3/8-18 UNC x 1" W/ Wshrs St Stl		
8	1	Lifting Bridle 316 St Stl	NCEL	EI-5101-0304
9	10	Grommet Bushing Delrin	NCEL	EI-5101-0401
10	1	Lanyard Handle 316 St Stl	NCEL	EI-5101-0306
11	1	Valve Lanyard 3/16"D Db1 Braided Dacron 20 Ft. Lg		
12	1	O.E.B. Slide Fastener Neoprene Coated Nylon, 30" Lg	TALON	STYLE 1731
13	1	4" Iris Diaphragm Dump Valve	NCEL	EI-5101-0501
14	1	Cord Sling, 7/16"D x 28.25"Lg, Kevlar W/Dacron Cover	NCEL	

550 LB LIFT BAG ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
15	3	Shackle, Safety Anchor, 3/4" 316 St Stl	McMAS & CARR	3860T57
16	6	Connection Cord Sling 3/8"D x 14.7"Lg Kevlar W/Dacron Cover	NCEL	
17	6	Shackle, Safety Anchor, 3/8" W/ Alloy St Pin	McMAS & CARR	3559T46
18	1	Lifting Ring Plate, Top 4 1/8" DIA. 316 St Stl	NCEL	EI-5101-0309
19	1	Lifting Ring Plate, Bottom 4 1/8" DIA. 316 St Stl	NCEL	EI-5101-0311
20	8	1/4-20 UNC Nuts and Washers St Stl		
21	10	Grommet, Washer Type, 3/4" DIA. Brass	McMAS & CARR	9604K8
22	1	Zipper Backing Neoprene Coated Nylon 10"W x 37"Lg	NCEL	EI-5101-0404

1250 LB LIFT BAG ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
1	1	Lift Bag, Neoprene Coated Nylon 500 / 1250 LB Range	NCEL	EI-5101-0202
2	20	Handle Cover Patch, Neoprene Coated Nylon	NCEL	EI-5101-0301
3	2	Top Handle, 12 inch Nylon	NCEL	EI-5101-0302
4	3	Bottom Handle, 24 inch Nylon	NCEL	EI-5101-0303
5	10	Buckle, PVC Male	Fast-Tex	BSR-2M
6	20	Buckle, PVC Female	Fast-Tex	BSR-2F
7	10	Bolt, Hex HD 3/8-18 UNC x 1" W/ Wshrs St Stl		
8	1	Lifting Bridle 316 St Stl	NCEL	EI-5101-0304
9	10	Grommet Bushing Delrin	NCEL	EI-5101-0401
10	1	Lanyard Handle 316 St Stl	NCEL	EI-5101-0306
11	1	Valve Lanyard 3/16"D Dbl Braided Dacron 20 Ft. Lg		
12	1	O.E.B. Slide Fastener Neoprene Coated Nylon, 48" Lg	TALON	STYLE 1731
13	1	4" Iris Diaphragm Dump Valve	NCEL	EI-5101-0501
14	1	Cord Sling, 7/16"D x 38.25"Lg, Kevlar W/Dacron Cover	NCEL	

1250 LB LIFT BAG ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
15	3	Shackle, Safety Anchor, 3/4" 316 St Stl	McMAS & CARR	3860T57
16	6	Connection Cord Sling 3/8"D x 14.7"Lg Kevlar W/Dacron Cover	NCEL	
17	6	Shackle, Safety Anchor, 3/8" W/ Alloy St Pin	McMAS & CARR	3559T46
18	1	Lifting Ring Plate, Top 4 1/8" DIA. 316 St Stl	NCEL	EI-5101-0309
19	1	Lifting Ring Plate, Bottom 4 1/8" DIA. 316 St Stl	NCEL	EI-5101-0311
20	8	1/4-20 UNC Nuts and Washers St Stl		
21	10	Grommet, Washer Type, 3/4" DIA. Brass	McMAS & CARR	9604K8
22	1	Zipper Backing Neoprene Coated Nylon 10"W x 55"Lg	NCEL	EI-5101-0402

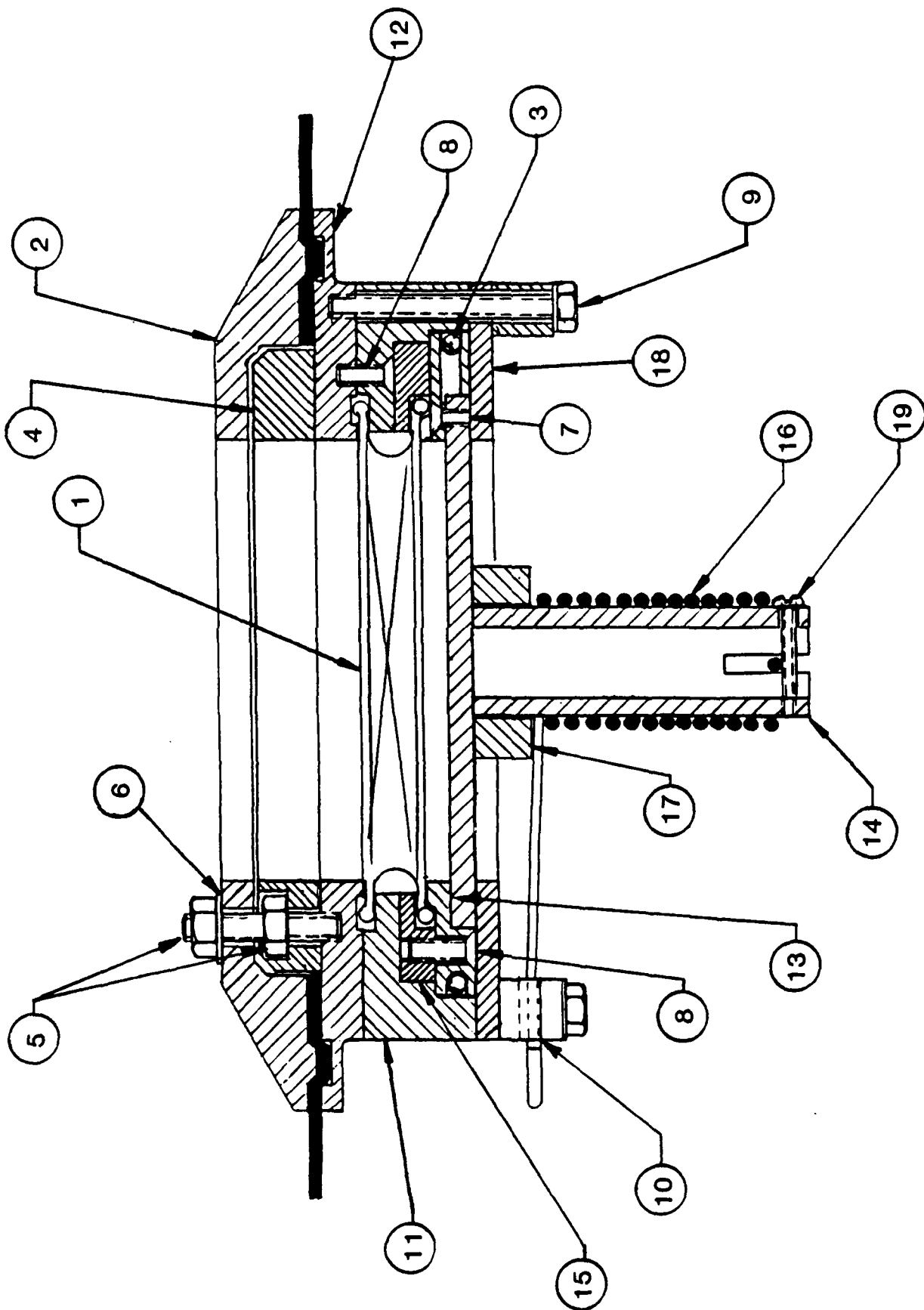
3000 LB LIFT BAG ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
1	1	Lift Bag, Neoprene Coated Nylon 1000 / 3000 LB Range	NCEL	EI-5101-0203
2	20	Handle Cover Patch, Neoprene Coated Nylon	NCEL	EI-5101-0301
3	2	Top Handle, 12 inch Nylon	NCEL	EI-5101-0302
4	3	Bottom Handle, 24 inch Nylon	NCEL	EI-5101-0303
5	10	Buckle, PVC Male	Fast-Text	BSR-2M
6	20	Buckle, PVC Female	Fast-Text	BSR-2F
7	10	Bolt, Hex HD 3/8-18 UNC x 1" W/ Wshrs St Stl		
8	1	Lifting Bridle 316 St Stl	NCEL	EI-5101-0304
9	10	Grommet Bushing Delrin	NCEL	EI-5101-0404
10	1	Lanyard Handle 316 St Stl	NCEL	EI-5101-0306
11	1	Valve Lanyard 3/16"D Dbl Braided Dacron 20 Ft. Lg		
12	1	O.E.B. Slide Fastener Neoprene Coated Nylon, 86" Lg	TALON	STYLE 1731
13	1	6" Iris Diaphragm Dump Valve	NCEL	EI-5101-0502
14	1	Cord Sling, 7/16"D x 67.75"Lg, Kevlar W/Dacron Cover	NCEL	

3000 LB LIFT BAG ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
15	3	Shackle, Safety Anchor, 3/4" 316 St Stl	McMAS & CARR	3860T57
16	6	Connection Cord Sling 3/8"D x 14.7"Lg Kevlar W/Dacron Cover	NCEL	
17	6	Shackle, Safety Anchor, 3/8" W/ Alloy St Pin	McMAS & CARR	3559T46
18	1	Lifting Ring Plate, Top 4 1/8" DIA. 316 St Stl	NCEL	EI-5101-0310
19	1	Lifting Ring Plate, Bottom 4 1/8" DIA. 316 St Stl	NCEL	EI-5101-0312
20	8	1/4-20 UNC Nuts and Washers St Stl		
21	10	Grommet, Washer Type, 3/4" DIA. Brass	McMAS & CARR	9604K8
22	1	Zipper Backing Neoprene Coated Nylon 10"W x 93"Lg	NCEL	EI-5101-0403

5.3 IRIS DIAPHRAGM DUMP VALVE ASSEMBLY



DIAPHRAGM DUMP VALVE (CUTAWAY)

EXHIBIT 5-4

4" IRIS DIAPHRAGM DUMP VALVE ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
1	1	4" Single Iris Diaphragm Rubber	Kemutec Inc.	Series A
2	1	Installation Plate, PVC	NCEL	EI-5101-0601
3	A/R	3/16" Dia, Double Braided Dacron		
4	1	Plate Spacer, PVC	NCEL	EI-5101-0603
5	16	1/4-20 Hex Nuts 316 St Stl		
6	12	1/4" Flatwasher 316 St Stl		
7	2	8-32 x 1/4 Flat Head Screw 316 St Stl		
8	12	10-32 x 5/8 Flat Head Screw 316 St Stl		
9	4	1/4-20 x 1 7/8 Hex Head Bolt 316 St Stl		
10	4	Spring Retention Clip PVC	NCEL	EI-5101-0808
11	1	Valve Body Black Delrin	NCEL	EI-5101-0701
12	1	Mounting Plate 316 St Stl	NCEL	EI-5101-0605
13	1	Actuator Black Delrin	NCEL	EI-5101-0705
14	1	Shaft / Strut Assembly 316 St Stl	NCEL	EI-5101-0811
15	1	Restraining	NCEL	EI-5101-0703

4" IRIS DIAPHRAGM DUMP VALVE ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
		Ring 316 St Stl		
16	1	Torsion Spring 302 St Stl	Associated Spring	T115-360-969
17	1	Spring Spacer Black Delrin	NCEL	EI-5101-0807
18	1	Cover Plate Black Delrin	NCEL	EI-5101-0801
19	1	6-32 X 1, Pan Hd Screw	McMaster-Carr	MS51957-34

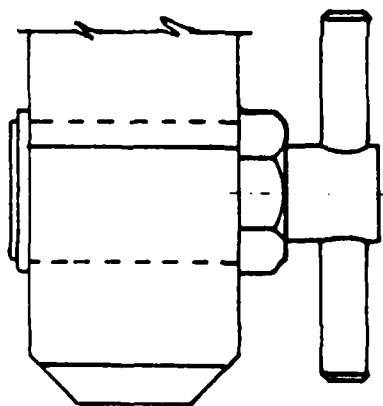
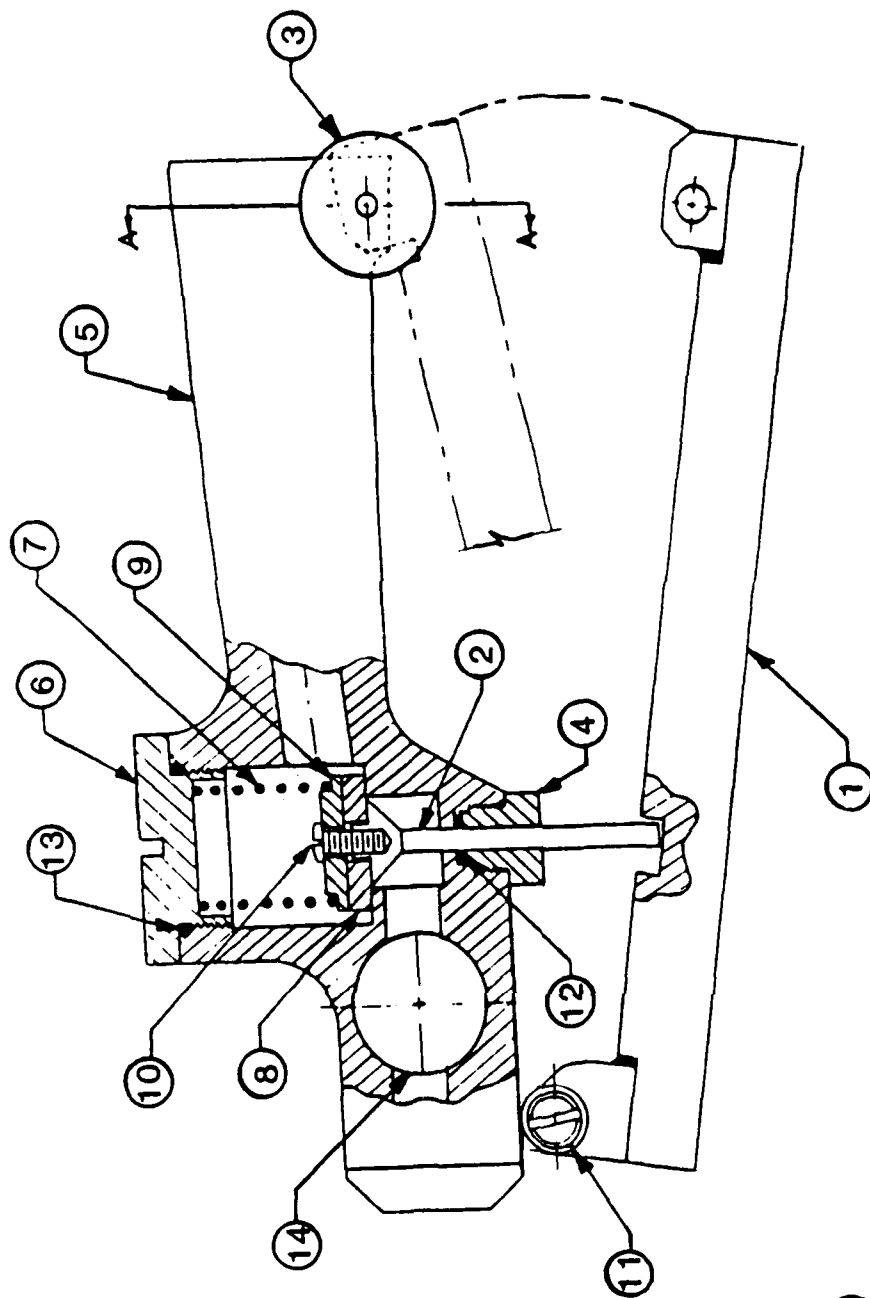
6" IRIS DIAPHRAGM DUMP VALVE ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
1	1	6" Single Iris Diaphragm Rubber	Kemutec Inc.	Series A
2	1	Installation Plate, PVC	NCEL	EI-5101-0602
3	A/R	3/16" Dia, Double Braided Dacron		
4	1	Plate Spacer, PVC	NCEL	EI-5101-0604
5	16	1/4-20 Hex Nuts 316 St Stl		
6	12	1/4" Flatwasher 316 St Stl		
7	2	8-32 x 1/4 Flat Head Screw 316 St Stl		
8	12	10-32 x 5/8 Flat Head Screw 316 St Stl		
9	4	1/4-20 x 1 7/8 Hex Head Bolt 316 St Stl		
10	4	Spring Retention Clip PVC	NCEL	EI-5101-0808
11	1	Valve Body Black Delrin	NCEL	EI-5101-0702
12	1	Mounting Plate 316 St Stl	NCEL	EI-5101-0606
13	1	Actuator Black Delrin	NCEL	EI-5101-0706
14	1	Shaft / Strut Assembly 316 St Stl	NCEL	EI-5101-0812
15	1	Restraining	NCEL	EI-5101-0704

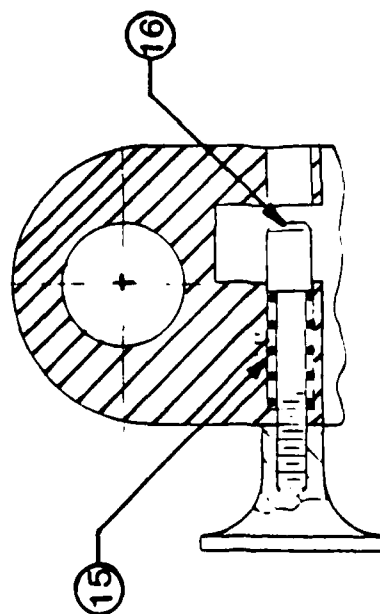
6" IRIS DIAPHRAGM DUMP VALVE ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
		Ring 316 St Stl		
16	1	Torsion Spring 302 St Stl	Associated Spring	T125-360-1084
17	1	Spring Spacer Black Delrin	NCEL	EI-5101-0807
18	1	Cover Plate Black Delrin	NCEL	EI-5101-0802
19	1	6-32 X 1", Pan Hd Screw	McMaster-Carr	MS51957-34

5.4 AIR FILL VALVE



DETAIL-(14)
THROTTLE-VALVE



SECTION A-A

AIR FILL VALVE (CUTAWAY)

EXHIBIT 5-5

AIR FILL VALVE ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
1	1	Lever St Stl	NCEL	EI-5101-1101
2	1	Valve Stem St Stl	NCEL	EI-5101-1003
3	1	Lockout Knob Delrin	NCEL	EI-5101-1106
4	1	Stem Cap 3/8-24 UNF Threads St Stl	NCEL	EI-5101-1005
5	1	Valve Body St Stl	NCEL	EI-5101-1001
6	1	Spring Cap St Stl	NCEL	EI-5101-1002
7	1	Spring St Stl	McMaster-Carr	9435K146
8	1	Seal, Valve 1/8" dia. Rubber	NCEL	EI-5101-1107
9	1	Washer St Stl	NCEL	EI-5101-1004
10	1	Bolt, Stem 6-32 x 7/16" Hex Head St Stl		
11	1	Bolt, Lever .187"D x 1.00" Slotted Shoulder Screw, St Stl	McMaster-Carr	91829A208
12	1	O-ring Buna-N	Parker	- 008
13	1	O-ring Buna-N	Parker	- 020
14	1	Plug Valve Stem Teflon Coated	Nupro	SS-P6T-K9
15	1	Spring St Stl	McMaster-Carr	9435K24
16	1	Lockout Shaft St Stl	NCEL	EI-5101-1105

5.5 AIR DISTRIBUTION SYSTEM

AIR HOSE ASSEMBLY

Find No.	Quantity	Description	Manufacturer	Part No.
1	3	3/4" Hose, 100 Ft Length	SYNFLEX	3600-12033
2	1	1/2" Hose, 25 Ft Length	SYNFLEX	3600-8033
4	3	Coupling Socket W/Ferrule St Stl	HANSEN	LL6-S32-SL
5	3	Plug W/Ferrule St Stl	HANSEN	LL6-T32
6	1	Plug St Stl	HANSEN	LL6-T31
7	1	Coupling Socket St Stl	HANSEN	LL6-531-SL
8	2	Hose Barb, Male 1/4" NPT St Stl		

**PURCHASE DESCRIPTION
FOR
DIVER LIFT SYSTEM**

1.0 SCOPE

1.1 This description establishes the design and performance requirements for a diver lift system with associated storage case. The system is designed to be operated in a marine environment by the Naval Underwater Constuction Teams (UCT's).

2.0 APPLICABLE DOCUMENTS

2.1 **Specifications.** The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent herein.

Military

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-794	Procedures for Packaging and Packing of Parts and Equipment.

2.2 **OTHER PUBLICATIONS.** The following documents form a part of this purchase description to the extent specified herein. Unless otherwise specified, the issue in effect on date of invitation for bids or request for proposal shall apply.

Naval Civil Engineering Laboratory Drawings

<u>Item</u>	<u>Eastport International Drawing No.</u>
General Bag Assembly	EI-5101-0100
4" & 6" Diaphragm Dump Valve Assy.	EI-5101-0500
Air Fill Valve Assembly	EI-5101-0900

Naval Civil Engineering Laboratory Technical Manual

Operation and Maintenance Manual: Diver Lift System.

The contractor shall verify all design dimensions and tolerances prior to commencing fabrication.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracing officer.)

3.0

REQUIREMENTS

3.1 **Description.** The diver lift system shall consist of: 1) three open bottom lift bags in the lift ranges of 220 to 550 lbs., 500 to 1250 lbs., and 1000 to 3000 lbs.; and 2) an air fill valve. Each bag shall have vertical control zippers which the diver opens or shuts as required to maintain the desired lift capacity of the bag. Excess air is automatically exhausted from the bottom of the zipper. The bags shall have diver-controlled iris-type dump valves located at the top of each bag for venting excess air. Each bag shall also contain an integral lifting bridle for rigging loads. The diver lift system shall include air delivery hardware consisting of air hose and a single-hand operable air supply valve. The entire system and its storage case shall be of size and weight transportable by two men by hand.

3.2 **Performance.** The system shall be capable of the following:

1) Operational Effectiveness

a) Load range

- in water 50 - 3000 lbs
- dry weight 60 - 5000 lbs

b) Operating depth range 0 - 190 ft

c) Operating environment

- sea state 0 - 3
- swell up to 4 feet waves
with an 8 - second
or longer period

d) Surface stability

The system shall be stable on the water surface (whether deployed over the side of a craft and then inflated / ballasted, or by controlled ascent from the seafloor) for a minimum of five minutes unattended and for one hour with diver attendance.

e) Vertical transport

ASCENT : In an elevator mode, the system shall be capable of attaining specific diver selected and adjusted ascent rates between 0.3 and 0.9 ft/sec within + 0.1 ft/sec.

DESCENT : The system shall be capable of attaining specific diver selected and adjusted rates between 0.3 and 0.9 ft/sec within + 0.1 ft/sec in water depths of 30 feet or greater. For depths less than 30 feet, the descent rate shall be less than 75 ft/min.

f) Hover control

At water depths greater than 20 ft, the system(s) shall be capable of hovering at depths to within the following: (a) + 3 ft for 30 minutes with diver attention; and (b) + 0.5 ft for 5 minutes with diver attention.

g) Positioning control

The system shall be capable of being controlled in ascent to rates of 0.1 ft/sec to 0.5 ft/sec for a vertical distance of 2 feet for gentle positioning, landing, and assembling.

If specified (see paragraph 6.2), preproduction inspection (see paragraph 4.2) shall be required.

3.3 COMPONENT REQUIREMENTS

3.3.1 **Lift Bags.** The diver lift system shall consist of three lift bags, one for each of the following lift ranges: 1) 220 - 550 lbs; 2) 500 - 1250 lbs; and 3) 1000 - 3000 lbs (the maximum full rated lifting capacity of each lift bag shall be approximately 10% greater than the upper limit specified in the lift range). The lift bags shall be open bottom type with a tear-drop shape. The lift bags shall be yellow in color and constructed of Neoprene coated Nylon or equal as shown on the design drawings. Maneuvering straps shall be located at numerous locations around the top and bottom perimeter of the bags.

3.3.2 **Control Zippers.** Each lift bag of the diver lift system shall have incorporated into the bag a corrosion - resistant, leakproof control zipper comparable to the Talon O.E.B. Slide Fastener or equal. The control zippers shall be of proper lengths suited to the bag sizes. The zippers shall be safe and easily operated mechanisms, suitable for prolonged use in the ocean environment.

3.3.3 **Labels.** The lift range of each lift bag shall be clearly marked on the side of each lift bag as well as buoyancy graduations near the control zippers. Warning labels shall be placed near the maneuvering straps stating that the straps are not to be used for lifting.

3.3.4 **Dump Valve.** An iris type diaphragm dump valve shall be provided for each lift bag. A 6 inch valve shall be provided for the 1000 - 3000 lb range lift bag, and a 4 inch valve shall be provided for each of the 220 - 550 lb and 500 - 1250 lb lift bags. The dump valves shall have a pressure balanced operation, operable by a lanyard, and have self closing operations. The force required to crack (open) the dump valves shall be 5 lb + one pound. The diaphragm shall be the rubber type comparable to that manufactured by Kemutec or equal. The valve shall be positively sealing and have no leakage when in the closed position. The device used to attach the dump valves to the bags shall allow for quick and easy field replacement of the valves.

3.3.5 Air Fill Valve. An air fill valve shall be provided with each diver lift system. The fill valve shall be constructed of materials suitable for long term use in the marine environment. The air fill valve shall be capable of withstanding 125 psi with no leakage. The air fill valve shall consist of two valves in a single unit assembly; a trigger actuated spindle valve, and a flow control plug valve capable of throttling.

3.3.5 Lifting Bridle. A lifting bridle shall be provided for each lift bag. The bridles shall attach to the base of each bag and shall be of welded stainless steel construction. The bridles shall; permit the attachment of connecting slings, provide a firm fixed opening at the bottom of the bag, permit easy change-out of lifting and connecting slings. The lifting bridles shall permit the transfer of all lifting loads to go through the bag and not to the bag material when the load is lifted from the water.

3.3.6 Lifting Eye. A lifting eye shall be provided for each lift bag. The lifting eyes shall be of welded stainless steel construction, be leak proof and located at the top of the lift bag. The lifting eye shall permit easy access to the eyelet and permit rapid hook-up for the lifting crane.

3.3.7 Sling. Each lift bridle shall have a complete set of lifting and connecting slings. The lifting slings shall be appropriately sized to each bag. The connecting slings shall be interchangeable between all bag sizes. All slings shall be constructed of Kevlar material or equivalent. Each sling shall have a stainless steel thimble securely spliced into each end. All connecting slings shall have the same color. Each lifting sling shall be color coded to a specific bag size.

3.3.6 Air Supply Hardware. The air supply hardware shall be suitable for extended periods in the marine environment. The hardware shall consist of pneumatic hose and fittings. The pneumatic hose shall consist of three sections of hose. Each section of hose shall be 100 feet long and have a working pressure of 250 psig. Each end of the sections of hose shall have a stainless steel, leak-proof, quick disconnect coupling. The three sections shall be capable of being joined together to make a single section of hose that is 300 feet long. Stainless steel fittings shall be provided that permit the leak-proof connection of the fill valve.

3.3.7 Storage Case. A storage case shall be provided of sufficient size and strength to contain the diver lift system. The interior shall be designed to hold the components of the diver lift system securely in place for transit without damage. In addition, the case shall provide permanent storage space for the operator's manual and the spare parts listed in paragraph 3.5. The case shall be constructed of plywood that may be expected to withstand use in a marine environment. It shall include a fully hinged lid and stainless steel military-style hardware.

3.4 Marking. The case shall be marked "DIVER LIFT SYSTEM" in block letters 1-inch high on all four sides and the top, using good commercial practices. The markings shall be in a contrasting color to the case exterior. A single coat of Clearcoat or equivalent shall be applied over the letters.

3.5 Spares. The following is a list of spare parts that shall be provided with each diver lift system:

- (1) Three (3) ea. Short maneuvering straps.
- (2) One (1) ea. Sling, cord, Kevlar, small bag
- (3) One (1) ea. Sling, cord, Kevlar, medium bag
- (4) One (1) ea. Sling, cord, Kevlar, large bag
- (5) Six (6) ea. Sling, conn. cord, Kevlar
- (6) Ten (10) ea. Bolts, St Stl 3/8-16UNC x 1" w/nuts & wshrs
- (7) One (1) ea. Lanyard, Nylon, 3/16" dia. x 20'
- (8) Three (3) ea. Shackle, safety anchor, St Stl 7/8"
- (9) Two (2) ea. Diaphragm, rubber
- (10) Ten (10) ea. Bushing, grommet, Delrin
- (11) Eight (8) ea. Nuts, St Stl, 1/4-20 UNC w/ wshrs
- (12)

3.6 Deliverables. The following is a list of deliverables required under this specification:

- a. One (1) diver lift system .
- b. One (1) pneumatic hose assembly.
- c. One (1) air fill valve.
- d. Spares as listed in paragraph 3.5.
- e. One (1) storage case of suitable design as constrained by paragraph 3.3.4.

The deliverable items a, b, c, and d, shall be placed inside deliverable item e in their individual, normal, proper stowage positions and shall be delivered as a complete package in accordance with MIL-STD-129 and MIL-STD-794.

3.7 Deviations and Waivers. All deviations and waivers from this specification shall be submitted to and approved by the Naval Civil Engineering Laboratory, Code L43, Port Hueneme, CA 93043 before incorporation.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure that supplies and services conform to prescribed requirements.

4.2 Inspection Classification and Requirements. Inspection shall be classified as follows:

- a. Preproduction inspection (see paragraphs 3.2 and 6.2)
- b. Quality conformance inspection.
- c. Packaging inspection.

4.2.1 Preproduction Inspection. Preproduction inspection shall be performed on one unit submitted as the preproduction model (see paragraph 3.2). This inspection shall include the examination described in paragraph 4.3 and all tests in paragraph 4.4.

4.2.2 Quality Conformance Inspection. Quality conformance inspection shall be performed on every diver lift system with storage case offered the Government. This inspection shall include the examination described in paragraph 4.3 and tests in paragraph 4.4.

4.2.3 Packaging Inspection. The preservation-packaging, packing, and marking of the diver lift system with storage case shall be inspected to verify conformance with the requirements of this specification and MIL-STD-129 and MIL-STD-794.

4.3 Examination. Each diver lift system with storage case shall be examined for compliance with the requirements specified in Section 3 of this specification. This element of inspection shall encompass all visual examinations. Noncompliance with any specified requirement or presence of one or more defects preventing or lessening maximum efficiency or safety shall constitute cause for rejection.

4.4 Tests.

4.4.1 Performance Test. The preproduction model shall be tested in accordance with the requirements of paragraph 3.2. Failure in any of the tests cited therein shall be cause for rejection.

5.0 PREPARATION FOR DELIVERY

5.1 Preservation and Packaging. Preservation and packaging shall be in accordance with the following:

5.1.1 Diver Lift System with Storage Case. The diver lift system with storage case shall be packaged and labeled in accordance with MIL-STD-794 and MIL-STD-129 (see paragraph 6.2).

5.1.2 Spares. The spares shall be packaged and labeled in accordance with MIL-STD-794 and MIL-STD-129 (see paragraph 6.2).

6.0 NOTES

6.1 Intended Use. The diver lift system is intended to be used by underwater construction teams where it is necessary to lift, position, or lower objects to the ocean floor.

6.2 Ordering Data. Procurement documents should specify the following:

- a. Title, number, and date of the specification.
- b. When the preproduction inspection is required (see paragraph 3.2).
- c. When a field inspection is required and whether field inspection is to be performed by the Government or by the contractor (see paragraph 4.1).
- d. Level of preservation and packaging required (see paragraph 5.1).

ENCLOSURE (1)

DIVER SALVAGE LIFT BAG INVENTORY

Box I

1 4131-1-01 lift bag
1 4131-2-01 lift bag
1 4131-3-01 lift bag
3 air hoses
1 lift bag repair kit
1 spare parts kit

Box II

1 4131-1-02 lift bag
1 4131-2-02 lift bag
1 4131-3-02 lift bag
3 air hoses
1 lift bag repair kit
1 spare parts kit

Box III

1 4131-1-03 lift bag
1 4131-2-03 lift bag
1 4131-3-03 lift bag
3 air hoses
1 lift bag repair kit
1 spare parts kit

Box IV

1 4131-1-04 lift bag
1 4131-2-04 lift bag
1 4131-3-04 lift bag
3 air hoses
1 lift bag repair kit
1 spare parts kit

Box V

1 4131-1-05 lift bag
1 4131-2-05 lift bag
1 4131-3-05 lift bag
3 air hoses
1 lift bag repair kit
1 spare parts kit



Box VI

1 4131-1-06 lift bag
1 4131-2-06 lift bag
1 4131-3-06 lift bag
3 air hoses
1 lift bag repair kit
1 spare parts kit

spare parts kit:

1 sling cord, kevlar small bag
1 sling cord, kevlar medium bag
1 sling cord, kevlar large bag
6 sling conn cord, kevlar
10 bolts, st.st., 3/8" UNC * 1", w/ nuts & washers
1 lanyard, nylon 1/4" dia * 20'
3 shackle, st.st., 3/4" safety anchor
1 4" rubber diaphragm w/ wire
1 6" rubber diaphragm w/ wire
10 bushing, grommet, delrin
8 nuts, st.st., 1/4"-20 UNC w/ 2 washers
5 flat washer, st.st., 1/4"
2 screw, st.st., flathead, 8-32 * 1/2"
5 screw, st.st., flathead, 10-32 * 5/8"
4 bolt, st.st., hexhead, 1/4-20 * 1 7/8"
1 4" shaft strut assembly
1 6" shaft strut assembly
2 spring, 4" or 6" valve
2 O-ring, BUNA-N, 3/16 * 5/16 * 1/16
2 O-ring, BUNA-N, 7/8 * 1 * 1/16
1 inflater

